

What is claimed is:

1. A system for banding a plurality of syringe barrels, the system including:
a feed device for receiving the plurality of syringe barrels and positioning the plurality of syringes according to a predetermined orientation;
a transfer device for transferring the plurality of syringes in the predetermined orientation to a transport device that receives and holds the syringes in a spaced relationship and moves them from one location to another location; and
a web application device disposed along the transport device for applying a first web material to a first face of a predetermined number of syringes and a second web material to a second face of the syringes and then pressing the first and second materials into contact with the first and second faces of the syringes, respectively, and into contact with each other in areas between the syringes so as to form a banded syringe structure.
2. The system of claim 1, wherein the feed device includes a centrifugal bowl feeder that receives the plurality of syringes in a random manner and includes tooling that positions the plurality of syringes in the predetermined orientation.
3. The system of claim 2, wherein the feed device includes a first transport device for receiving the syringes from an exit port of the bowl feeder and delivering them to the transfer device in the predetermined orientation.

4. The system of claim 3, wherein the first transport device comprises a feeder rail that includes a drive feature for advancing the syringes from the exit port to the transfer device.

5. The system of claim 4, wherein the drive feature comprises a straight line drive unit that produces linear vibratory motion that results in the syringes being advanced sequentially along the feeder rail to the transfer device.

6. The system of claim 5, wherein the feeder rail includes a first side rail and a second side rail with a space being formed therebetween for receiving the syringes, each of the first and second side rails having a flange formed at an upper end thereof that extends inwardly toward the other flange, wherein the syringes hang within the feeder rail as a result of a syringe barrel flange seating against the flange of the feeder rail.

7. The system of claim 3, wherein the tooling includes an internal feed track and the transfer device comprises a mechanism for disengaging the syringes from the feed track and directing them to the first transport device by generating a stream of air and directing it at the syringes.

8. The system of claim 1, wherein the transfer device comprises a rotary device that has a plurality of individual receiving sections that receive the syringes in a manner in which each syringe is separated from the other and held within its own receiving section as

the rotary device rotates to deliver the syringes from the feed device to the first transport device.

9. The system of claim 8, wherein the receiving sections comprise a number of grooves formed radially around an outer edge of the rotary device which is in the form of a vacuum rotary device connected to a vacuum source, each of the grooves having a plurality of vacuum ports that are connected to the vacuum source such that negative pressure is selectively produced within the grooves.

10. The system of claim 9, wherein the rotary device is in communication with a controller that permits the vacuum source to be selectively disconnected from the vacuum ports of one of the grooves resulting in the disengagement of the syringe from the one groove.

11. The system of claim 1, wherein the transport device comprises a conveyor belt assembly that receives the syringes from the transfer device and delivers them to another location, the belt assembly including a first belt and a second belt spaced therefrom with a space being formed therebetween, the first and second belts having aligned features that receive and hold the syringes in a spaced relationship with a predetermined distance between adjacent syringes.

12. The system of claim 11, wherein the aligned features comprise a plurality of fingers that are formed as part of the first belt and the second belt with each pair of fingers on the first belt being aligned with an opposite pair of fingers formed on the second belt, one syringe being nested within the two pairs of opposite fingers with a barrel of the syringe extending across the space.

13. The system of claim 11, wherein the rotary device includes a number of grooves formed radially around an outer edge of the rotary device which is in the form of a vacuum rotary device connected to a vacuum source, each of the grooves having a plurality of vacuum ports that are connected to the vacuum source such that negative pressure is selectively produced within the grooves and the transport device comprises a conveyor belt assembly that receives the syringes from the transfer device and delivers them to another location, the belt assembly including a first belt and a second belt spaced therefrom with a space being formed therebetween, the first and second belts having aligned features that receive and hold the syringes in a spaced relationship with a predetermined distance between adjacent syringes, the transport device being disposed proximate the rotary device so that one groove is disposed above and in alignment with one aligned pair of belt features in a transfer position to permit transfer of one syringe.

14. The system of claim 13, wherein the rotary device and the transport device are indexed devices that communicate with a controller such that as the rotary device advances the syringes held therein are successively brought into alignment with an empty

pocket defined by the aligned features and the controller instructs the vacuum source to be selectively disconnected from the groove in the transfer position.

15. The system of claim 1, wherein the web application device comprises one or more web presses that are disposed on opposite sides of the transport device such that the web application device presses the first web material against the first face of the syringes and presses the second web material against the second face of the syringes and into contact with each other in areas between the syringes so as to form a banded syringe structure.

16. The system of claim 15, wherein the one or more presses comprises four presses, each press having a first actuator with an associated first press head for pressing the first web material against the first face and a second actuator with an associated second press head for pressing the second web material against the second face, the four presses being disposed adjacent one another, each press being activated independently from the others so that the four presses are successively activated and moved into extended positions where the first and second web materials are pressed, thereby forming the banded syringe structure.

17. The system of claim 16, wherein each of the first and second actuators is a pneumatic cylinder that is operatively coupled to the first and second press heads, respectively.

18. The system of claim 16, wherein each of the first and second press heads has a longitudinal groove formed therein for receiving a barrel of the syringe when the press head is pressed against the syringe with the respective web material being disposed therebetween.

19. The system of claim 1, wherein the web application device comprises a pressing device that has a number of parts that are successively activated to press the first and second web materials to form the banded structure, each of the parts moving between an extended position wherein the part presses the respective web material into contact with one syringe and a retracted position where the part is spaced from the syringe.

20. The system of claim 1, wherein the first web source comprises a single side adhesive tape and the second web source comprises a single side adhesive tape.

21. The system of claim 19, further comprising at least one idler roll disposed between the first and second web materials and the web application device for applying and maintaining the first and second web materials under tension.

22. The system of claim 19, further comprising at least one web guide roll disposed proximate to and downstream of the web application device for initially receiving a free end of one of the first and second web materials, the web guide roll acting to hold and

align the web material so that a length thereof is disposed underneath the parts of the web application device and axially aligned relative thereto and relatively to the syringe.

23. The system of claim 22, wherein the web guide roll comprises a clip that holds the free end of the web material to permit the pressing device to be activated resulting in the banding of a select group of syringes, the system including a cutter for cutting the first and second pressed web materials at a location upstream of the web application device and before advancement of the transport device.

24. A system for banding a plurality of syringe barrels, the system including:
a feed device for receiving the plurality of syringe barrels and positioning the plurality of syringes according to a predetermined orientation;

an indexed device for transferring the plurality of syringes in the predetermined orientation to a transport device that includes individual pockets for receiving and holding the syringes in a spaced relationship as the syringes are advanced due to movement of the transport device; and

a web application device disposed along the transport device for applying a first web material to a first face of a predetermined number of syringes and a second web material to a second face of the syringes and being configured to press the first and second materials into contact with the first and second faces of the syringes, respectively, and into contact with each other in areas between the syringes so as to form a banded syringe structure.

25. The system of claim 24, wherein the first and second faces are opposite one another.

26. The system of claim 24, wherein a guide mechanism guides the first web material across and above the first face of the syringes as well as guiding the second web material across and below the second face of the syringes.

27. The system of claim 24, wherein the web application device includes a plurality of independent parts that are controllable so that they can be successively moved from a retracted position to an extended position in which the parts apply pressure against the first and second web materials to produce the banded structure.

28. The system of claim 24, wherein the indexed device and the transport device are in communication with a controller that indexes the relative movements thereof, the transport device being advanced until a selected group of syringes are introduced into the web application device and then held for a period of time to permit the selected number of syringes to be banded after which time, the transport device is advanced so that a selected group of unbanded syringes is introduced into the web application device.

29. The system of claim 28, wherein the indexed device remains stationary for the period of time when the selected group of syringes is banded.

30. The system of claim 24, wherein the indexed device comprises a vacuum rotary device that is connected to a vacuum source and the syringes are selectively held within individual compartments of the indexed device, whereupon deactivation of the vacuum source in a selected individual compartment results in the syringe held therein being transferred by gravity to one of the individual pockets formed along the transport device.

31. The system of claim 30, wherein the indexed device is indexed so that movement thereof in one interval is performed simultaneous with the advancement of the transport device one unit such that the syringe departing the indexed device is transferred into an empty pocket.

32. A method of banding a plurality of syringes comprising the steps of:
introducing the plurality of syringes into a feeder;
aligning the plurality of syringes in a predetermined arrangement and delivering the aligned syringes to a rotary device;
advancing and controlling the rotary device so that syringes held therein are successively delivered to a transport device that holds and maintains the syringes in a spaced relationship,
advancing the transport device such that the syringes are delivered to a web application device;
activating the web application device to cause a first web material to be

applied to a first face of a group of syringes and a second web material to be applied to a second face of the group of syringes, the first and second web materials being pressed into contact with the first and second faces of the syringes, respectively, and into contact with each other in areas between the syringes so as to form a banded syringe structure; and

advancing the banded syringe structure from the web application device.

33. The method of claim 32, wherein advancing the indexed device includes the step of advancing the indexed device one interval, while simultaneously advancing the transport device one unit such that the syringe departing the indexed device is transferred into an empty pocket formed along the transport device for retaining and holding the one syringe.

34. The method of claim 32, wherein activating the web application device comprises the steps of:

successively activating a plurality of press heads that form the web application device such that each press head presses one of the first and second web materials against one of the group of syringes; and

holding each activated press head in the extended position until at least all of the press heads are activated and assume the extended position.

35. The method of claim 34, wherein the number of press heads is two times the number of syringes in the group of syringes.

36. The method of claim 34, further comprising the steps of:

initially feeding the first web material through a first web retainer that is upstream of the web application device and initially feeding the second web material through a second web retainer that is upstream of the web application device;

retaining the first and second web materials under tension within the first and second web retainers, respectively, prior to the step of advancing the transport device such that the syringes are delivered to a web application device; and

cutting a banded section of the first and second web materials after the banded syringe structure is formed but before advancing the banded syringe structure from the web application device.

37. The method of claim 32, wherein the steps of introducing the syringes

into a feeder and aligning the plurality of syringes in a predetermined arrangement and delivering the aligned syringes to a rotary device comprise the steps of:

introducing the syringes into a centrifugal bowl feeder which is activated resulting in the syringes being aligned in the predetermined arrangement; and

receiving the aligned syringes from the bowl feeder through an exit port and into a feeder rail device;

activating the feeder rail device to cause it to linearly vibrate resulting in the syringes being transported a length of the feeder rail device to the rotary device.